DESIGN SUMMARY

LAKE TIPPECANOE
INDIAN CREEK DETENTION BASINS

October 2000

Prepared for:

Tippecanoe Environmental Lake and Watershed Foundation
P.O. Box 55
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DESIGN SUMMARY
LAKE TIPPECANOE
INDIAN CREEK DETENTION BASINS

I. PROJECT DESCRIPTION AND PURPOSE

The project involved the construction of two detention basins on Indian Creek, a tributary of Lake Tippecanoe. The two detention basins were designed to decrease the velocity of the flow through Indian Creek and reduce the phosphorus and fecal coliform bacteria discharge to Lake Tippecanoe. Approximately 60 acres of the Tippecanoe Country Club and another 60 to 100 acres of adjacent agricultural land are drained by an extensive network of tiles which outlet to form the beginning of Indian Creek. These tiles had a combined total diameter of 104 inches. This efficient drainage system delivers water to Indian Creek at a much greater volume and velocity than would otherwise reach the creek through natural overland and ground water flow. These high flow rates to Indian Creek have caused severe erosion and instability of the channel downstream of the tile outlets. In addition, the tiles carry excessive loads of phosphorus, nitrogen, and fecal coliform bacteria. The two detention structures will reduce the water velocity, thereby precipitating phosphorus, reducing fecal coliform bacteria levels and decreasing erosional scouring of the stream bed. All permits necessary for this project are attached as Appendix A and a landowner agreement is attached in Appendix B.

II. DESIGN RATIONALE

Standard engineering calculations were used for sizing the basins, outlet pipe and outlet dam. These engineering calculations are contained in Appendix C along with the soil boring report.

A. Detention Basins

The detention basins were sized to effectively control runoff from a 10-year storm event and release the runoff to Indian Creek over a 24-hour period. The 10-year storm event was chosen as the design flow because these events occur relatively frequently and produce a manageable amount of runoff. The 24-hour time period will eliminate 90% of the fecal coliform, as coliform bacteria generally do not survive more than 24 hours in open water. This design criteria allows the basins to be cost-effectively sized and provide treatment and protection to Indian Creek and Lake Tippecanoe. The computer modeling results for basin design is described in the Feasibility Study, November, 1998.

B. Outlet Structure

The outlet structure consists of two risers, an 8-inch and a 6-inch located within the basin at the low point. The risers are encased in one-inch diameter stone to protect them from damage and provide filtration of the runoff. The 8-inch riser is the main outlet rising vertically from the basin bottom to a height of 2 feet. It is a solid, PVC pipe with an open end protected by a bar screen which keeps solids from entering the pipe. The 6-inch riser is a perforated, PVC pipe also rising to a height of 2 feet. This riser is capped and only allows flow through the 1-inch holes along its length.

The multi-outlet system offers an important advantage over a single-pipe outlet. With a single pipe, storm events less than the 10-year event will not achieve the necessary detention or treatment. However, with the two risers, the water from any storm event will be backed up to the 2 foot level and allowed to slowly filter through the perforations along the 6-inch riser. Additionally, the 8-inch riser provides the necessary outlet for the 10-year storm event.
In the event of a larger rainfall, a spillway of large natural stone carries a 100 year event.

C. Energy Dissipaters

Energy dissipaters are used at the pipe outlets to ensure that the flow from the basin outlet pipes do not contribute to the erosional scouring of the creek bed. The dissipaters are constructed of fieldstone and form a ring around the outlet. As the water discharges from the pipe, the dissipaters interrupt the straight-line flow from the pipe. The flow is slowed down and spread out, thus reducing the energy and velocity of the discharge.

D. Emergency Spillway

The emergency spillway is included for protection of the surrounding lands and the integrity of the basin structures. Storm events, such as a 100-year event, cause runoff volumes which can overwhelm man-made structures. The outlet pipes are not sized to handle such large events. During a large storm event, the basins will become completely full and the spillway then becomes the primary outlet for the basin. The spillway directs the excess flow along a path which will control potential erosion and damage to adjacent areas.

III. DESIGN SPECIFICATIONS

A. Basin Earthwork

A copy of the report "Subsurface Investigation & Geotechnical Recommendations" by Alt & Witzig Engineering, Inc. is attached in Appendix C. This report gives recommendations for construction of the basins and contains the soil boring logs. One of the key items within the report is the importance of a stable base for the embankments which will not cause settlement. The report

recommends the removal of the soft, top-layer soils to achieve a proper base for compaction which will not cause unacceptable future settling.
Fill material for the detention basins shall contain no more than five percent organic material. Fill shall be free of trash, rubble, or other man-made objects. Fill shall contain no particles larger than four inches, and the plasticity index of the fraction passing the #40 sieve shall not be more than 25%.

Dewatering equipment shall be used to maintain a dry excavation. Dewatering shall lower the water level below the established excavation level before the excavation reaches that level. The dewatering method shall not disturb the density of the sub-grade soils. Dewatering shall be discontinued gradually at a rate not to exceed 25% of the pumping capacity every 3 days or equivalent until all dewatering has ceased.

Sufficient quantities of excavated material suitable for the growth of vegetation shall be preserved from within the excavation area and used for the encasement of all slopes that are to be mulched, seeded or sodded as required.

Embankments and berms shall be constructed true to within 0.1 ft of the lines and grades shown or specified. Embankments and berms shall be constructed using suitable job-excavated material.

B. Erosion Control

Where necessary, a straw bale dike shall be constructed for erosion control. All straw bale dike material shall be removed at the completion of the project. Upon completion of each basin, all disturbed soils will be immediately seeded and covered with straw matting .

C. Clearing and Grubbing

Surface objects, trees, stumps, roots, rocks, and other protruding objects not designated to remain shall be cleared and grubbed. Undisturbed sound stumps, roots, and nonperishable solid objects may be left provided that they are a minimum of four feet below the sub-grade or final grade on slopes and embankments.

Cleared materials shall not be buried on the project site. Materials and debris shall not be disposed of in low lying areas or wetlands. The Country Club has designated a disposal area for stumps. Logs will be hauled off site. Branches and smaller trees will be chipped and spread on site.

D. Pipe Trenching

The pipe trenching shall be as recommended by the manufacturer of the pipe to be installed. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as

recommended in the manufacturer's installation manual. The trench width below an elevation one foot above the top of pipe shall not exceed that recommended in the installation manual. Where no manufacturer's installation manual is available, trench walls below an elevation one foot above the top of pipe shall be vertical and trench walls one foot or more above the top of pipe shall be adequately sloped as required to prevent slides and cave-ins unless proper precautions, as stipulated by OSHA, are taken.

Pipe shall be bedded in compacted Class I or Class II material, placed on a flat trench bottom. The bedding shall have a minimum 4 inch thickness below the pipe and shall extend to 12 inches above the top of the pipe level the full width of the trench. All material shall be placed in the trench in a maximum of six inch layers (before compaction). Each layer, shall be leveled and evenly distributed on both sides of the pipe so as not to disturb, displace or damage the pipe and shall be adequately compacted. When Class I materials are used compaction may be accomplished by hand or mechanical tamping or by "walking" the material in. When Class II materials are used compaction shall be accomplished only by hand or mechanical tamping.

Class I materials shall meet the following requirements: angular, ¼ inch to 1-1/2 inches, graded stone such as crushed stone.

Class II materials shall meet the following requirements: coarse sands and gravel with maximum particle size of 1-1/2 inches, including various grades of sands and gravel containing small percentages of fines, generally granular and non-cohesive, either wet or dry.

IV. CONSTRUCTION SCHEDULE

The project was scheduled to begin the first working day in January 1999. The project began on that day and was completed in May of 1999 with the installation of plant plugs in the basins.

Tasks	**Date of Construction**
1) Remove trees from designated work area	Jan 1- Jan 10, 1999
2) Excavate basins to size shown on plans	Jan 10 - Feb 10, 1999
3) Replace 24 inch culvert from junction box	Feb 10-15, 1999
4) Install dams with outlet structures/rock armor	Feb 15-28, 1999
5) Install seed and erosion control cloth in basins	March 1-30, 1999
6) Repair construction access and use spoils for constructing contours on fairways, seed.	April 1-30, 1999

7) Plant shrubs and wetland plants in basins May 1-30, 1999

V. MAINTENANCE ACTIVITIES

The primary maintenance activity will be inspections of the outlet structures by the landowner each month and after each rain event. The outlet pipes and energy dissipaters should be clear of leaves and other debris. Accumulated debris should be removed to allow unimpeded flow out of the detention basins. Maintaining these areas clear of debris will also prevent this material from flowing into the lake.

Although the detention basins were designed to be dry bottom, ground water saturates the basins forming permanent wetlands. The basins were planted with native aquatic vegetation which should flourish without maintenance. The basins should be cleaned of sediment and organic matter only if they become completely choked with plants such that risers are getting plugged after every precipitation event or if the bottom of the natural flow path exceeds the height of the lower riser. The detention basin dams should be inspected monthly for evidence of damage from erosion or burrowing animals. Any damage should be repaired immediately. Repair will consist of backfilling any holes or eroded areas with available then seeding and covering with straw mulch. Attached as Appendix C is an inspection form for construction and maintenance.

VI. PROJECT CONCLUSIONS

The two designed and constructed retention basins are functioning to hold water and release it slowly downstream. The basins are supporting a good population of wetland plants that will soon dominate the otherwise one-three inch deep open water in the center of the basins as well as the remainder of the basins which are saturated permanently. The basins have held up well under several 10 year storm event after construction. Monthly inspection and cleaning of the outlet risers is a necessity due to the number of leaves that clog the gravel filter as it flows into the six inch riser. It is expected that these structures will continue to work as designed and provide benefits to the lake for many years into the future.

MAINTENANCE INSPECTION FORM

Project Name: Indian Creek Detention Basins

Date: _____

Weather Conditions: _____

1. Is the Inlet Structure clear of debris? If not, remove all accumulated debris from the structure.

2. Is the Outlet Structure clear of debris? If not, remove all accumulated debris from the structure.

3. (a) Is the Energy Dissipater in its original configuration?

(b) Is the Energy Dissipater functioning as proposed?

4. Is there evidence of erosion on the side slopes of the dam?

5. Is the detention basin completely vegetated? Please provide recommendations for vegetating bare areas.

6. Is there any bank erosion occurring downstream of the structure?

7. Other observations.

Inspector Signature and Printed Name: _____

Mail completed form to: **Tippecanoe Environmental Lake and Watershed Foundation**
P.O. Box 55
North Webster, Indiana 46555

APPENDIX A

PERMITS

APPENDIX B

LANDOWNER AGREEMENT

APPENDIX C

ENGINEERING CALCULATIONS

and

SOIL BORING REPORT

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EXECUTIVE SUMMARY

Two one-half acre stormwater detention basins were constructed at the outlet of drainage tiles that formed the beginning of the Indian Creek drainage on the Tippecanoe Country Club, Leesburg, Indiana. The basins were designed to hold up to a 10 year storm event for a 24 hour period to reduce the amount of phosphorus, nitrogen and bacteria entering the stream and flowing to Lake Tippecanoe. In addition, this detention was also to slow the release rate of storm water to the creek to reduce the rate of erosion of downstream banks and thus decrease the sediment load to the lake. The basins were designed to be dry bottom, maintainable extensions of the existing golf course. As built, the detention basins are permanently saturated, forming a good wetland plant medium. These wet basins are reducing nutrient loading to the lake and reducing the velocity of water entering the creek. The project should be maintained monthly by inspecting and removing leaves and debris from the stone around the perforated PVC outlet structure.